River Mile 10.9 Removal Action Perimeter Air Monitoring Plan, Lower Passaic River Study Area

Prepared for

Cooperating Parties Group, Newark, New Jersey

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Acronyms and Abbreviations

BMP	Best Management Practices
COPC	chemical of potential concern
mg/L	milligrams per litre
µg/m^3	micrograms per cubic meter
LPR	Lower Passaic River
LPRSA	Lower Passaic River Study Area
m	meter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NJDEP	New Jersey Department of Environmental Protection
NJAC	New Jersey Administrative Code
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-p-dioxins
PCDF	Polychlorinated Dibenzofurans
PID	Photo Ionization Detector
PUF Filter	Polyurethane Foam Filter
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RM	River Mile
RI/FS	Remedial Investigation / Feasibility Study
SOP	Standard Operating Procedure
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
XAD	Polymeric resin bead filter

1.Introduction

1.1. Overview

Perimeter air monitoring is to be conducted by the CPG and its contractors during the RM 10.9 Removal Action. This Perimeter Air Monitoring Program (PAMP) prescribes appropriate management measures and monitoring that protects the public living and working adjacent to the removal area at RM 10.9 from potential airborne contaminants. Specifically, the plan protects nearby residents, recreational users of the park and the park worker. This PAMP is in conjunction with the Community Health and Safety Plan.

The perimeter air monitoring program will be initiated a few days prior to the start of dredging in July 2013 and continue through until the completion of field work early December 2013. There are two aspects of the air monitoring program; real-time air monitoring which provide results immediately during the removal operations, and samples that are collected over a 24-hour period and sent to a laboratory for analysis. Real-time air monitoring will occur during dredging/capping operations roughly 12-hours a day 6-days a week. Twenty-four (24) hour composites samples are collected during the operational and non-operational times of day 6-days a week. Some monitoring may be reduced or eliminated pending regulatory approval at the completion of dredging and not conducted during the capping portion of the project.

1.2. Program Objectives

The main objective of this program is to identify air monitoring and management response measures to be implemented during dredging and capping operations that limit potential exposures to the public. This program details the monitoring and associated warning values which if reached, will be used to initiate further investigation into the cause(s) and impacts that these works may be having on the public in the vicinity of dredging operations, as well as to determine the appropriate management response. This response may include temporary cessation (stop work) of dredging and capping activities if the impact is found attributable to either, to allow for time to effectively resolve the matter and assure that air monitoring levels return to below-warning values.

1.3. Potential Air Emissions: Conceptual Model

The primary activity which could potentially cause air related concerns is the removal of sediment and placing it on the barge. The question that needs to be addressed is whether the sediment or water contain a level of contaminants that could emit vapors or dust and be an inhalation concern to the public. The contaminants at RM 10.9 such as Dioxins/Furans and PCBs have low vapor pressures and adhere tightly to the sediment particles, and thus do not have high vapor emission potential. The

contaminants that do have high emission potential such as volatile organics and selected semi-volatile organic compounds such as naphthalene are found at low levels within the RM 10.9 sediment.

The nature of the exposure at an off-site public location can be:

- Sub-chronic, or shorter-term (typically occurring for a few months or a year), or
- Chronic, or longer-term, (typically occurring for several years),

The RM 10.9 dredging activities will only occur for approximately 60-90 days so this is considered a sub-chronic exposure duration. Given the concentration of chemicals of potential concern (COPCs) found in the sediment adverse health effects are not anticipated. Health risks – if any - would only be associated with long-term exposure and not any incidental or short term exposure since:

- The potential adverse health effects from the inhalation of these constituents are associated with much higher concentrations than are reasonably generated in an open air setting by dredging-related dust emissions; and
- Natural atmospheric dispersion and particulate deposition (by gravity, winds, rain or through contact with buildings and structures) prevent high dust concentrations from persisting in the ambient air.

The exposure point concentration for target chemicals in the air at off-site locations where a member of the public may inhale it is conceptually made up of two components:

- The concentration of a chemical that is typically present in the outdoor air that is unrelated to the dredging activities (i.e. the baseline ambient air concentration or "background") and
- The concentration of that chemical that is present due to the transport and dispersion of dust from the removal operations.

The overall purpose of implementing an air monitoring and sampling program at the site is to:

- Establish background levels
- Monitor and document perimeter ambient air levels of target COPCs
- Compare results with screening levels based on appropriate human exposure scenarios
- Determine when to implement appropriate dust and/or odor control measures and/or amend best management practices (BMPs)
- Document actual conditions during the removal action

Due to the proximity of the public to the dredge and barge loading in the vicinity of RM 10.9, the NJDEP requested that the CPG evaluate the potential of the dredging operations to create air emissions (Potential to Emit (PtE)). Potential emissions are assumed to come from the dredged sediment while it is being removed from the river and placed in a barge. Sediment data from the removal area was used for the PtE calculations. The PtE for dioxins and PCBs are 3.5 and 4.5 times below the NJDEP reporting threshold respectively. For all other COPCs present in the RM 10.9 sediment, the PtEs are orders of magnitude below the NJDEP reporting threshold.

The removal process requires the dredge bucket to be pulled through the river water so there will be a fair amount of water with the sediment. The sediment will then be stored and handled on the barge wet. Wet sediment will remain on the barge until it reaches the downstream stabilization facility; during that short time (< 1 day) it is not expected to dry, so very little dust is expected to be generated. It is

unlikely that there will be other emissions generated from this process. However wind-borne dust and vapor as a transport pathway with regards to potential inhalation exposure hazards to the public was evaluated and will be monitored.

While PtE calculations show no exceedance of NJDEP reporting threshold values, there is the potential for odors from the operation. The COPCs contained within the sediment that will be dredged generally do not have odors at the concentrations found within the sediment. The most likely odor associated with sediment is that of hydrogen sulfide (H_2S), the rotten egg smell. All natural occurring sediment/dirt will have some odor to it due to the organic matter (decaying leaves, aquatic plants etc.) that has been buried with it. Many sediment samples have been collected from the RM 10.9 area and the levels of hydrogen sulfide have been very low and hardly noticeable. If odors are detected during dredging, they are expected to be more of a nuisance than a potential health impact to the public. Potential odor is included in this monitoring plan.

The CPG will conduct real-time air monitoring for selected indicator compounds supplemented by air sampling and analysis for target COPCs to document the actual conditions.

The PtE calculations requested by NJDEP showed that Volatile Organic Compounds (VOCs) are below NJDEP permitting thresholds. Hydrogen sulfide has been monitored during all sediment collection activities conducted for many years and the levels have been below monitoring requirements. Nevertheless, real-time monitoring of VOCs and hydrogen sulfide will be conducted downwind of the dredging operations at RM 10.9. The hydrogen sulfide monitoring is more for odor control than for a health risk. Real-time monitoring and sampling for particulates (dust) will be conducted at specific fixed locations depending on wind direction surrounding the dredging operations at RM 10.9.

Concentrations of the target COPCs measured in this program will be compared to an appropriate risk-based screening level at the point of potential exposure. These screening levels will be chemical-specific concentrations or concentration limits on total dust (particulates) that are established to be protective of human health assuming potential exposure throughout the duration of the dredging project.

The air monitoring plan will consist of the following:

- real time monitoring of meteorological data to determine what areas are downwind of removal activities,
- real-time monitoring for (VOCs),
- monitoring of hydrogen sulfide (rotten egg smell),
- real-time monitoring of dust (particulates),
- 24-hour composite samples at fixed locations for particulates (dust) to be analyzed for targeted COPCs that would adhere to dust particles.

2.

3.Proposed Controls

3.1. Overview

The proposed Removal Action dredging and capping operations have the potential to release into the air environment what should be low levels of particulates and vapor. Further details of the dredging and capping activities, including volumes and equipment, are provided in the Final Design Report which was submitted and reviewed separately by the United States Environmental Protection Agency (USEPA) and New Jersey Department of Environmental Protection (NJDEP).

This Program describes an air monitoring regime to provide advance warning of conditions that could have the potential to exceed human health risk assessment warning levels and to respond to and manage such events, including investigation and mitigation measures.

3.2. Dredging/Capping Operational Controls

The following Best Management Practices (BMP) will be employed during the dredging/capping operations to minimize the potential for an impact to air quality:

- The use of an environmental clamshell bucket minimizes the air flow and will reduce odor from the dredging process and dredged sediment.
- Maintain expeditious movement of the closed bucket to the receiving barge after completing a cut to reduce water leakage from the clamshell bucket into the river to the extent practicable.
- Prohibit raking for debris removal.
- Keep sediment in barge moist.
- Minimize the exposure time of newly excavated surfaces at low tide.

4.Air Monitoring

Air monitoring will be conducted using a combination of upwind and downwind monitoring stations at fixed and mobile units to provide the best coverage of the removal action operations. As noted the potential of emissions from the dredging operation is expected to be very low due to the moist conditions during sediment handling. The monitoring will consist of real-time direct measurements and 24-hour integrated whole air particulate samples. Real-time monitoring will measure VOCs, H_2S and airborne dust to guide the implementation of BMPs to reduce emissions if necessary. The 24-hour particulate samples will provide the necessary information to document the primary COPCs that are potentially adsorbed to airborne particles or present in vapor-phase.

4.1. Monitoring Stations

A goal of an air monitoring program is to detect air quality impacts coming from the project area by comparing results from upwind and downwind monitoring stations. This makes choosing appropriate monitoring locations an important consideration. The monitoring locations have been selected based on prevailing wind direction, electric power accessibility, and proximity to potential receptors. Wind roses were prepared from wind data for Newark airport. Nine years' worth of data from 1981 to 1990 for the months in which the removal action will take place (July, August, September, October) indicate the prevailing wind directions are from the west and north and lesser degree from southwest and northwest. Based on the prevalent wind conditions and configuration of the removal area the primary receptors are those east of the river in the park and east of the park. The monitoring locations are described below and presented in Figure 1.

In River Station (IRS) #1 - one location on the river which includes real-time monitoring equipment (VOCs, Dust/Aerosol, H_2S) and 24-hour composite particulate sampling equipment for COPCs. This equipment is mounted on a floating platform that will be moved periodically to best monitor the operations.

Park Monitoring Station (PMS) #1 and PMS #2 each includes real-time monitoring equipment (VOCs, Dust/Aerosol, H_2S) and 24-hour composite particulate sampling equipment for COPCs. PMS #3 is a 24-hour composite particulate sampling location. Locations PMS #1 and PMS #3 will remain in the same locations for the duration of the project. PMS #2 will be moved from the south location to the north location as dredging progresses upstream to best monitor the operations.

Mobile #1 includes real-time monitoring equipment for VOCs, Dust/Aerosol, and H_2S. Mobile #1 will be located primarily adjacent to the dredging operations in the park however can be easily moved to other locations if necessary to address issues.

The on-site weather station will provide continuous wind direction information to determine which monitoring locations are upwind versus downwind at any given time.

3.1.1. In River Monitoring Stations

Based on prevalent winds, there will be one primary upwind (background) monitoring station(IRS #1) established on the river to provide data on the quality of air coming into the project area. The western

shore of the river would be a good location for upwind locations except for the proximity to Highway 21 and configuration constraints due to the limited shoreline width. CPG proposes putting the upwind air monitoring equipment on a floating platform in the river. The floating platform will then be moved as the dredging progresses to keep location IRS #1 prevalently upwind, though at times IRS #1 may be considered a downwind monitoring station depending on wind direction determined by the on-site weather station.

3.1.2. Park Monitoring Stations

Due to the irregular shape of the removal area and the possible prevailing wind directions, the primary downwind real-time air monitoring location will be a mobile one (Mobile #1) located primarily adjacent to the dredging operations in the park however, can be easily moved to other locations if necessary to address issues. In addition, there will be three fixed locations (PMS #1, PMS# 2, and PMS #3) at all times. For example, dredging begins in the southern half of the removal area, PMS #1, #2, and #3 will be as depicted on Figure 1. As the project progresses upstream, equipment at monitoring location PMS #2 will be moved to the north location shown in Figure 1.

4.2. Real-Time Monitoring

Real-time monitoring is used to identify promptly when additional investigation or control measures are needed. Real-time monitoring will consist of monitoring for VOCs and dust as well as hydrogen sulfide. Real-time monitoring for VOCs and dust will be conducted at stations IRS #1, PMS #1, PMS #2 and Mobile #1. Real-time monitoring will also include an automated weather station that will be used to monitor wind direction, wind speed, ambient temperature, relative humidity and barometric pressure at the fixed location weather station.

The following are the key elements of the real-time monitoring system to be utilized:

4.2.1. VOC Monitoring

Air will be monitored for VOCs continuously and averaged on 15-minute intervals at stations IRS #1, PMS #1 and #2 and Mobile #1 surrounding the dredging operations to verify that total VOC concentrations within the Park and beyond do not exceed the air indicator established by EPA for this project.

VOC monitoring equipment will consist of photo-ionization detectors (PIDs) via MiniRAE-3000 or equivalent equipment that measures VOC concentrations continuously. The equipment logs real-time data and calculates a 15-minute average. This equipment will be operational during the 12-hour dredging/capping operations shift. Equipment information and SOPs are provided in Attachment 2.

4.2.2. Particulate (Dust) Monitoring

Dust/aerosol will be monitored to verify that concentrations at downwind locations of the dredging/capping operations remain below the air indicator criteria for PM_{10} concentrations.

The particulate monitoring will be conducted with a Thermo MIE DataRam Aerosol Monitor or equivalent capable of monitoring a range of particulates in the air from 1 ug/m^3 to 400,000 ug/m^3. Details of the dust monitoring data collection, operation, and calibration are provided in the air monitoring SOP (Attachment 2).

4.2.3. Hydrogen Sulfide Monitoring

Many sediment samples have been collected from the RM 10.9 area and the levels of hydrogen sulfide have been very low with odor barely noticeable. Sensitive receptors can smell the "rotten egg" odor of H_2S at low concentrations in air 0.5 ppb (0.0005 ppm) and 90 percent of people can smell it at levels of 50 ppb (0.05 ppm). A Jerome Hydrogen Sulfide Analyzer Model J631-X portable gas monitor or equivalent will be used to detect hydrogen sulfide with a range of 0.003 ppm to 50 ppm hydrogen sulphide in four graduated ranges. The data will be collected real-time and averaged over a 15 minute period. The instrument information and SOPS are provided in Attachment 2.

4.2.4. Noise Monitoring

Noise monitoring will consist of sound level measurements and done manually by field personnel periodically while in the park attending to the air monitoring equipment. At a minimum, a reading will be collected once every three hours during the daytime 12-hour construction shift. Additional monitoring will be conducted if there are complaints of noise from people in the park or nearby residents. Routine monitoring will occur along the shoreline 100 feet north, 100 feet south and at the mid-point of the removal area. The noise monitoring will be conducted with a sound level monitor such as the Extech 407730 Digital Sound Level Meter or equivalent capable of measuring sound pressures level in dB from 40 to 130 dB. The New Jersey daytime maximum hourly noise average standard is 75 dB.

4.2.5. Meteorological Measurements

There will be on-site meteorological data collection station located within the park near the RM 10.9 removal area (Figure1). The weather station will continuously monitor and record the following; air temperature, air pressure, wind direction and speed, precipitation quantity and intensity and relative humidity. The wind direction and speed will be used to ensure that air monitoring stations are properly situated to monitoring the dredging activities and to document the conditions during the removal action.

Project personnel will have access to and routinely monitor other weather information sources such as the National Weather Service website and broadcasts as a backup to the on-site real-time weather station.

Details of the real-time monitoring equipment, operation, calibration methods are provided in Attachment 2.

4.3. COPCs Monitoring

In addition to the real-time monitoring of dust, a composite sample of the dust will be collected during 24-hour periods at four locations, one on the river and three in the park (IRS #1, PMS #1, PMS #2, and PMS #3) which surrounds the dredging /capping operations, and these samples will be analyzed for select COPCs. The results will be reviewed during the project and compared to human health risk based criteria as described in Section 3.7. If these criteria are exceeded then appropriate dust controls measure will be implemented. Due to the concentrations in the sediment, the potential dust

concentration of contaminants does not pose an acute (short term) hazard, therefore it is not necessary to monitor for individual COPCs in real-time. Samples that are collected will be analyzed at a laboratory that will provide results in 3 to 5 days. The sampling approach and laboratory methods are listed in Table 3-1.

The 24-hour composite samples will be collected using portable high volume (or equivalent) ambient air sample pumps and the appropriate particulate size selector and filter, PUF sampler cartridge, or XAD cartridge as required by the analytical method. The COPCs that will be analyzed include mercury, PCBs, and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD) toxicity equivalent (TEQ).

During the first week of dredging (Days 1 through 6 of dredging) simultaneous samples for dioxin, PCBs, mercury and PM10 will be collected at the following locations PMS#1, PMS #2 and PMS #3. Due to limitations of equipment at location IRS #1 only 3 of the 4 parameters will be collected with dioxin and PCBs samples collected in an alternating scheme.

During week 2 of dredging there will be two days where simultaneous samples for dioxin, PCBs, mercury and PM10 will be collected at the following locations PMS#1,PMS#2 and PMS#3. Due to limitations of equipment at location IRS #1 only 3 of the 4 parameters will be collected with dioxin and PCBs samples collected in a rotating scheme.

After this start-up monitoring (Week 1 and 2), and until results are received, the sampling will follow the rotating schedule provided below. These samples will be analyzed with rapid turnaround of 5 days. Once data from the start-up is reviewed it is anticipated that the frequency of COPC sampling will be able to be decreased to 1 time per week.

After the start-up sampling, not all samples collected each day will be analyzed for all COPCs. A rotating scheme will be used to analyze the COPCs. An example rotating scheme is as follows;

Day 1 – PM 10 and Mercury
Day 2 – TCDD
Day 3 – PCB
Day 4 – Start over collecting PM10 and Mercury
Day 5 – TCDD

Day 1 the 24-hour composites from IRS #1, PMS #1, PMS #2, and PMS #3 will be analyzed for PM 10, and mercury. On Day 2 the 24-hour composites from IRS #1, PMS #1, PMS #2, and PMS #3 will be analyzed for TCDD, etc.

When the dredging operations reach the removal area that contains the highest concentrations of COPCs (transects 28+00 to 21+00) simultaneous samples for dioxin, PCBs, mercury and PM10 will again be collected. This monitoring will include the following locations PMS#1, PMS #2, and PMS #3. Due to limitations of equipment at location IRS #1 only 3 of the 4 parameters will be collected with dioxin and PCBs samples collected in a rotating scheme. The length of this intensive sampling will depend on the previous results but could be 2 to 6 days. Details of the high volume sampling data collection, operation, and calibration are provided in Attachment 2.

Table 3-1 COPC Sampling and Analysis Approach

Parameter/Category	Method	Sampling and Analysis Approach	Reporting Limits
2,3,7,8-TCDD	USEPA TO-9A (particulate and gaseous phase)	Ambient air (high volume or equivalent) is drawn through quartz-fiber / polyurethane foam absorbent in a 24 hour period. Analytical procedures are extract followed by HRGC-HRMS	10 pg
Total PCBs	USEPA TO-4A (particulate and gaseous phase)	Ambient air (high volume or equivalent) is drawn through quartz-fiber / polyurethane foam absorbent in a 24 hour period. PCBs are extracted from media and analyzed per GC	1.0 ug
Particulate Matter PM-10	PM10 and Total Suspended Particulate by NIOSH Method 0500	Ambient air (high volume or equivalent) is drawn via a 10 um size inlet through a glass fiber or quartz filter. Gravimetric particulate concentration based on weight difference.	200 µg
Mercury	Test America Knoxville Procedure for Filter Media Metals Digestion, KNOX-MT-009 and KNOX-IP-0003r6TAL	Ambient air (high volume or equivalent) is drawn via a 10 um size inlet through a glass fiber or quartz filter. Extraction followed by TAL metals analysis for mercury.	0.01 ug

Test America – Knoxville - Attachment 3 Analytical SOPs. Particulates size captured will be 10 micrometers in diameter and less.

4.4. Barge Transport Monitoring

The barges used to transfer dredged sediment from RM 10.9 to the stabilization facility are part of the dredging operations so will be included in the air monitoring while at those locations. The dredge material will be wet and may have a layer of water on top of it as the sediment settles to the bottom of the barge and residual water comes to the top. For this reason and as shown in the PtE calculations performed for NJDEP (Attachment 4), emissions from the barged material will be low. It is anticipated that barges full of dredged sediment will only be stationary for very short periods of time, less than an hour, during the trip from RM 10.9 to the stabilization facility preventing downwind impacts.

Air monitoring of barge emissions will be conducted by setting up a real-time monitor (Mobile #1 – VOCs, dust/aerosol, hydrogen sulfide) alongside the barge while it is stationary at the downwind side before it begins the first trip down river and only for the first barge filled unless results indicate a reason for additional monitoring.

4.5. Baseline Monitoring

Prior to the commencement of dredging activities, the fixed air monitoring stations will be installed and at least 48 hours of monitoring will be conducted. These composite samples will be sent to the laboratory and analyzed for 2,3,7,8 TCDD and PCBs as the primary COPCs of concern. Similarly, monitoring of the park with the mobile devices will be conducted prior to dredging.

4.6. Monitoring Frequency and Durations

Air monitoring for the RM 10.9 Removal Action will occur for the duration of the dredging operations at the frequency listed in Table 3-2.

Table 3-2 Removal Action Air Monitoring Details

Monitoring Location	Type of Monitoring Point	Monitoring Frequency	Description of Location
In River Station (IRS #1)	Real time VOCs, Aerosol-Dust, Hydrogen Sulfide	Continuous – averaged every 15 minutes (Frequency may change as project progresses)	Located on a floating platform in the river
	Particulates sample collection analyzed for a COPC each day	24 Hour composites daily; during dredging	
Park Monitoring Station Mobile #1	Real time VOCs, Aerosol-dust, Hydrogen Sulfide	Continuously averaged for 15 minutes at each location (Frequency may change as project progresses)	Adjacent to dredging/capping operations and random locations as needed in the park
	Noise	Once every three hours during the daytime 12-hour construction shift	Shoreline north and south 100 feet of the removal area Shoreline mid-point of the removal area
Park Monitoring Station (PMS #1)	Particulate sample collection analyzed for a COPC each day	24 Hour composites daily; during dredging	Fixed location within the park
	Real time VOCs, Aerosol-dust , Hydrogen Sulfide	Continuously averaged every 15 minutes (Frequency may change as project progresses)	
Park Monitoring Station (PMS #2)	Particulate sample collection analyzed for a COPC each day	24 Hour composites daily; during dredging	Fixed location within the park – south and north areas
	Real time VOCs, Aerosol-dust , Hydrogen Sulfide	Continuously averaged every 15 minutes (Frequency may change as project progresses)	
Park Monitoring Station (PMS #3)	Particulate sample collection analyzed for a COPC each day	24 Hour composites daily; during dredging	Fixed location within the park - central area
Down wind of sediment barge (Using Mobile #1 equipment)	Real time VOCs, Aerosol-dust, Hydrogen Sulfide	Before first sediment barge begins the trip to the stabilization facility	On the river down wind of the sediment barge

4.7. Project-Specific Risk-Based Ambient Air Action Levels

This section describes the basis and calculation of risk-based ambient air action levels for potential public exposure to the target parameter contaminants in the dust associated with contaminated sediment during the sediment dredging. Project-specific risk-based action levels (RBALs) were developed to verify the effectiveness of control measures and to verify that average exposures to the public remain below RBALs during sediment removal activities. In addition, a tiered set of responses are described for implementation when an action level is reached. The RBALs were developed specifically for the planned duration of the removal action and can be refined, as needed, to reflect new information or changes in site conditions that may occur during the remediation. (Section 4 lists the specific RBALs calculated for the RM 10.9 Removal Action project. Attachment 1 describes how the RBALs were calculated. This section discusses the basis of the calculations.)

4.7.1. Chemicals of Potential Concern

The actions taken to address sediment concentrations in the RM 10.9 Sediment Deposit Area are based on concentrations of identified chemicals of potential concern (COPCs): mercury, polychlorinated biphenyls (PCBs), and polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs). The planned method to address these COPCs is to mechanically dredge the sediment from the RM 10.9 Removal Area, place the sediment in containers for offsite disposal, and then cap the newly exposed surface sediment. Dredging activities are currently scheduled to begin in summer 2013 with an anticipated duration of less than 60 days during daylight hours (up to 12 hours per day, six days per week).

4.7.2. Conceptual Exposure Model

Sediment handling will be performed in a manner to limit generation of dust during the dredging. RBALs have been developed for use with air monitoring to address the potential for windborne migration of sediment related dust/particulate or volatile emissions into the neighboring adjacent park and nearby offsite residential areas. Based on the close proximity of the dredging to the adjacent park and nearby residential area the following potential inhalation exposure pathways primarily of COPCs in dust associated with contaminated sediment have been identified; recreational users, park workers, and residents.

4.7.3. Exposure Point Concentrations

Air concentrations will be monitored during the planned activities at offsite stations that will be installed near the RM 10.9 Removal Area as discussed in Section 3.1 within downwind areas where there is the potential for exposure. The exposure point concentration for COPCs in the air at an off-site location where potential receptors may be exposed is composed of the baseline ambient air concentration ("background") concentration and the concentration present due to the dredging. There are no site-specific ambient air concentrations available for COPCs in the vicinity of the RM 10.9 sediment; however, there are air monitoring results in the vicinity of the area for PCBs, and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD) toxicity equivalent (TEQ) concentrations for dioxins and furans. Air monitoring for dioxins (2,3,7,8-TCDD TEQ) and total PCBs was conducted in March 2012 prior to a separate dredging project 7 miles downstream in the Lower Passaic River. The 2012 average

background 2,3,7,8-TCDD TEQ concentration in that location and time was 2.1E-08 µg/m^3 and the average background PCBs concentration was 0.0016 µg/m^3.

4.7.4. Development of Project-Specific Risk-Based Action Levels

The RBALs for the RM 10.9 Removal Action are chemical-specific levels based on an inhalation exposure pathway. RBALs may be used to determine when response(s) are warranted to maintain protectiveness of receptors potentially exposed to COPCs in air during the planned activities.

The RBALs were calculated using the methodology presented in the *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (USEPA 2012) which are intended to develop levels representative of long-term (i.e., lifetime) exposures. Site-specific exposure parameters that are more appropriate to the duration of the dredging were incorporated in the RBALs calculations. For the park worker exposure scenario at the neighboring park, it was assumed that inhalation could occur for 8 hours in a workday which represents USEPA's standard default exposure for various occupational activities (USEPA 1991). While the offsite resident inhalation exposure duration coincides with the 12-hour dredging schedule since that is the only activity that could produce a potential exposure, a exposure duration of 24-hours has been requested by EPA.

The equations used to calculate the RBALs for the receptors incorporate these exposure factors and inhalation toxicity values to estimate chemical concentrations in air that correspond to the target levels of $1x10^{-6}$ excess lifetime cancer risk and non-cancer hazard quotient of 1 for each target organ and non-carcinogenic endpoint. The exposure assumptions and toxicity values used to calculate the RBALs for recreational users, park workers, and residents are presented in Attachment 1 Tables A-1 through A-3, respectively.

The inhalation toxicity values (non-cancer reference concentration [RfC] and cancer inhalation unit risk factors [IUR]) were obtained following USEPA's recommended hierarchy of toxicity sources including USEPA's Integrated Risk Information System (IRIS), California Environmental Protection Agency (Cal EPA), and World Health Organization (WHO). The inhalation toxicity values are presented for each COPC in Tables A-1 through A-3 of Attachment 1. For PCBs, the toxicity values appropriate for Aroclor 1254 were used in the risk-based calculations.

4.8. Quality Control

Quality Control is the overall system of technical activities that measures the attributes and performance of a process. QC activities are used to ensure that measurement uncertainty is maintained within acceptance criteria for the project objectives. Day-to-day QC activities are implemented through the use of various checks or instruments that are used for comparison. The analytical laboratory has a Quality Management System (QMS) to assess the reliability and validity of the analyses being performed at their facility.

Test America Knoxville has current certification for the analytical methods to be used in the air sampling component of this project.

All purchased or rented supplies and consumables will be inspected to assure that the quality and function will adhere to the standards necessary to meet all project objectives. Documented inspection

and acceptance criteria are necessary to ensure consistency of supplies. All sampling equipment prior to field deployment will be assembled and run in the CPG field facility. The field operators will perform external and internal leak checks and temperature, pressure and flow rate verification as required by the method. If any of these checks are out of specification, the field technicians will perform corrective action or the equipment will be replaced by the vendor.

4.8.1. Operation and Calibration of Air Monitoring Equipment

All instruments will be routinely inspected and undergo calibrated according to the manufacturer specifications for frequency and duration of calibration. All calibrations of the real time monitoring equipment will be recorded on a field calibration sheet (Attachment 1). Any quality assurance (Q/A) checks to confirm instrument accuracy performed will also be recorded on the calibration sheets. Throughout the day real time monitoring on the centralized database will provide real time data to assure the field equipment is in proper working order.

Calibration of the equipment will begin at one air monitoring station and will continue on to the next air monitoring station once quality assurance of all equipment at the station has been completed and verified by the field technician. The real time air monitors will be operating on a 24 hour cycle and the associated Q/A checks of the instruments will be completed as close to the 24 hour cycle as possible in concert with that time period.

Real-time equipment calibration will be required for the PIDs, dust/aerosol and hydrogen sulfide analyzer. Photoionization detectors (MiniRae 3000™ or equivalent) will be calibrated each day to the manufactures specifications. This briefly includes a zero calibration followed by a span calibration using a known concentration of isobutlyene gas. Confirmation of the calibration will completed with the sample isobutlyene gas. The Thermo DataRam-400™ dust and aerosol monitors will undergo a zero calibration at least once per day and when deemed necessary by the field technician. The Jerome 631-X ™ hydrogen sulfide analyzer will undergo a zero calibration at least once per day and when deemed necessary by the field technician. Additionally, the Jerome 631-X™ requires sensor regeneration at a frequency of once per day or at the discretion of the field technician. Sensor regeneration clears the analyzer of any hydrogen sulfide build up through the sampling period. Any factory required calibrations will not be performed in the field. The monitoring equipment that will require recurrent factory re-calibration will be removed from service prior to the factory recommended date and replaced with an up to date piece of equipment until it has been serviced of the same make/model with current calibration certification.

The 24-hour composite particulate sampler, Tisch PUF™, will be calibrated using the manufacturer's specifications when the equipment has been installed at its associated air monitoring station. Periodic calibrations will be performed on a monthly basis, when moving locations, or if any maintenance has been performed on the motor. All calibration data will be recorded on data sheets (Attachment B).

4.8.2. Laboratory Quality Controls

Laboratory QA/QC will be in accordance with the analytical method requirements for the air particulates sampling conducted. The laboratory QA/QC components will include instrument calibration activities, blank sample analysis, laboratory control sample, and spike recoveries. CPG's contractors, CH2M HILL

and Test America, Knoxville, will ensure sample collection, holding times, calibration procedures and handling times will be in accordance with appropriate USEPA and NIOSH air sampling and analytical methods. The data will include QA/QC elements specified by the appropriate analytical method. Data validation of the analytical results will be performed by LDC the approved data validators for LPRSA. The purpose of data validation is to assess the effect of the analytical process on the usability of the data. The data validation and review process is independent of the laboratory's QC checks and focuses on the usability of the data to support the project data interpretation and decision making processes. Data validation will follow EPA Region 2 validation guidance as well as those National Function Guidelines.

4.8.3. Real Time Monitoring Quality Assurance

Each real-time monitoring station is connected to a cellular modem that uploads data to a central database so that the project team can monitor the data in real-time. During field calibrations, an general inspection of the monitoring station electronics will be performed to ensure that the modem is on and connected operating normally with connection to the cellular service, no wiring is loose, all of instrument cabling and connections are properly stowed and secured, and that the instruments are properly connected, and any. Any additional observations related to the proper working order of the monitoring station. Any relevant observations will be recorded in the field note book and field personnel will contact the project manager or designee immediately to report any issues in the functionality of the monitoring station. Each station will also be inspected prior to the end of the day's dredging activities and note any observations made in the field note book.

Any alarms of the action levels sent from the central database will be monitored and recorded in the field log book. Project management will be notified immediately for further decision making. A log book will be kept to record daily activities, observations, and any changing site conditions. At a minimum frequency of once per week all data will be downloaded from the central database and saved in the project files.

5.Response

5.1. Real-Time Monitoring – Warning and Action Levels

Real-time air monitoring will be used to provide an early warning to prevent elevated offsite exposures and document conditions occurring during remedial activities. If action levels are exceeded, appropriate actions will be implemented to mitigate potential exposure. Table 4-1 lists the real-time monitoring action levels that will be implemented for VOCs, dust and hydrogen sulfide.

Table 4-1. Real-Time Monitoring – Warning and Action Levels with Responses

Parameter/Action Level	Concentration	Response
VOCs - Warning Level	5 ppm above background (determined at the upwind location) is exceeded over a 15-minute period	Work activities are temporarily suspended and the source of VOCs investigated. Activities may continue after VOC concentrations fall below 5 ppm over a 15 minute period, or if the source of the VOC is determined not to be associated with Removal Action activities.
VOCs – Action Level	10 ppm above background (determined at the upwind location) is exceeded over a 15-minute period	Operations will be suspended until the VOC level returns to below the action level within a subsequent 15-minute period either naturally or as a result of corrective measures, unless it can be demonstrated through investigation that dredging is not the cause of the exceedance.
Dust – Warning Level	100 ug/m^3 of above background (determined at the upwind location) is exceeded over a 15-minute period	The source of the dust will be investigated and if necessary corrective measures will be implemented.
Dust – Action Level	450 ug/m^3 above background (determined at the upwind location) is exceeded over a 15-minute period	Operations will be suspended until the dust level returns to below the action level within a subsequent 15-minute period either naturally or as a result of corrective measures, unless it can be demonstrated through investigation that dredging is not the cause of the exceedance.
Hydrogen Sulfide – Warning Level	0.01 ppm above background (determined at the upwind location)is exceeded over a 15-minute period	The source of the hydrogen sulfide will be investigated and if necessary corrective measures will be implemented.
Hydrogen Sulfide – Action Level	0.02 ppm above background (determined at the upwind location)is exceeded over a 15-minute period	Operations will be suspended until the hydrogen sulfide level returns to below the action level within a subsequent 15-minute period either naturally or as a result of corrective measures, unless it can be demonstrated through investigation or comparison of upwind and downwind data that dredging is not the cause of the exceedance.

5.2. COPC Monitoring – Warning and Action Levels

RBALs were calculated using EPA methods and are based on the exposure period assumptions described above for the public receptors (recreational users, park workers, and residents) and the projected duration of less than 90 days of the dredging (Attachment 1 - Table A-4). They represent the average concentration of COPCs that correspond to the most protective of the target cancer risk level or target hazard if a receptor inhaled air with that concentration over the assumed exposure time. Emissions of particulate dust during the dredging will fluctuate over time resulting in fluctuations of air concentrations at the monitoring stations. As such, these action limits should be viewed as the average target concentrations to be maintained. Monitoring station air concentrations above these RBALs for short durations do not necessarily reflect an immediate or an imminent health risk. Instead, comparisons of the air concentrations at the monitoring stations to these RBALs will be used to guide operations. Recommendations are presented in Table 4-2.

Table 4-2. COPC Monitoring Action Levels

Action Level	Resident	Park Worker	Recreational User	Response
2, 3, 7, 8 TCDD TEQ (ug/m^3) 24-hour sample				
Warning Level	1.92×10^{-5}	5.7×10^{-5}	1.5×10^{-4}	Notify EPA within 24 hours of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken.
Action Level	2.4×10^{-5}	7.1×10^{-4}	1.9×10^{-4}	Notify EPA immediately of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken within 3-days of identifying the exceedance.
PCBs (ug/m^3) 24-hour sample				
Warning Level	0.088	0.568	0.648	Notify EPA within 24 hours of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken.
Action Level	0.11	0.71	0.81	Notify EPA immediately of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken within 3-days of identifying the exceedance.
Mercury (ug/m^3) 24-hour sample				
Warning Level	1.9	2.96	7.76	Notify EPA within 24 hours of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken.

Action Level	2.4	3.77	9.7	Notify EPA immediately of receipt of analytical data Prepare a summary of data for time period of exceedance and any corrective action taken within 3-days of identifying the exceedance.

Warning level is 80 percent of Risk Based Levels (Attachment 1 Table A-4)

5.3. Operations Below Warning and Action Levels

Daily air monitoring records are to be kept at the CPG field facility and are to be available for inspection. Reporting of the perimeter air monitoring data will depend on the conditions in which the data was collected and the type of data collection (real-time versus delayed analysis). Real-time perimeter air monitoring data summary for daily operations below all action levels will be provided to USEPA weekly. A data summary of particulate sampling events and preliminary COPC particulate data results received will be provided to EPA weekly. A summary of this information will be posted on the CPG's web site weekly.

5.4. Warning Level Exceedance

If an air monitoring parameter is measured at or above the warning value specified, the CH2M HILL construction manager or safety coordinator (or delegate) will be responsible for overseeing the process of investigation and determination of the appropriate mitigation and other corrective measures in consultation with on-site CPG representatives and other relevant on-site personnel.

If an air monitoring parameter exceeds a warning level the following documentation will be collected, and not limited to the sampling location, time, date, meteorological conditions, location of dredging operations, and the corrective and other measures taken in response to the event. Where relevant, the details of other in-river activities unrelated to RM 10.9 Removal Action will also be noted.

CH2M HILL/dmi will notify EPA's Project Manager within 24-hours if there is an exceedance of a 'warning level' from the time of occurrence for real-time monitoring and receipt of analytical data for COPC particulate monitoring. Further details will be provided in a weekly data summary with descriptions of any corrective actions taken to reduce the levels below the warning level.

5.5. Action Level Exceedance

The CH2M HILL construction manager or safety coordinator (or delegate) will be responsible for overseeing the process of investigation and determination of the appropriate mitigation and other corrective measures in consultation with on-site CPG representatives and other relevant on-site personnel.

Dredging/capping activities will resume only when:

1) It is established that all dredging/capping plant and equipment is operating in a proper and efficient manner; and
2) Appropriate corrective measures have been implemented (note: any modifications to the operation undertaken for the specific purpose of addressing the increase due to dredging must restore air monitoring levels to below the action value within 15 minutes from the time of initiating the response; otherwise activities will remain suspended until this result is achieved).

If factors related to the RM 10.9 dredging activities are, or are likely to be, contributing to the action level exceedances, then the corrective and/or contingency measures identified in Section 5 may be applied.

Details that will be recorded in the event of an exceedence will include, but not be limited to the sampling location, time, date, tidal movements, meteorological conditions, location of dredging operations, and the corrective and other measures taken in response to the event. Where relevant, the details of other in-river activities unrelated to RM 10.9 Removal Action will be noted.

If a real-time monitoring 'action level' is exceeded due to dredging operations, CH2M HILL/dmi will notify the EPA Project Manager or designate immediately. Daily monitoring reports will be provided and a report identifying the cause of the exceedance and details of any corrective actions implemented, will be provided within 3-days.

Samples which are collected will be delivered to the laboratories on the same day where feasible, in accordance with the air monitoring and laboratory SOPs. An expedited turnaround time will be requested from the laboratories at the time of sample delivery, however, given the many external dependencies and inability of the laboratory to commit to a minimum turnaround period on results, this period cannot be guaranteed and will be subject to continual review. The results of the analytical analysis then will be compared the project specific risk based action levels that are described below.

While the data is being validated the preliminary results will be compared to the RBALs and the appropriate action or documentation will be performed. Once the data is validated the results will be shared as specified by data submission requirements of the LPRSA RI/FS. The data will also be provided in the RM10.9 Removal Action final report.

6.Contingency Measures

A range of contingency measures are available to apply in response to air monitoring measurements above the warning/action values where they are found attributable to the RM 10.9 Removal Action dredging and capping activities. The implementation of any of these contingencies will be determined by either the CH2M HILL construction manager or safety coordinator (or delegate) in consultation with on-site CPG representatives and other relevant on-site personnel.

These measures may include:

- Additional air quality monitoring;
- Modifying the dredging/capping operational parameters;
- Modifying the dredging/capping equipment, including bucket
- Reconfiguring the dredging operations; and
- Modifying or suspending activities until air quality is restored to below action values.
- Modifying action levels with concurrence from EPA if background levels consistently exceed action levels.

The written information provided in status reports will include the following:

- A description of the incident, its cause, and any contributing factors
- The exact dates and times of non-compliance
- If not yet corrected, the amount of time anticipated to correct the non-compliance
- Corrective actions taken or planned to prevent a recurrence

7. References

California Environmental Protection Agency (CalEPA). 2008. CalEPA – Office of Environmental Health Hazard Assessment Toxicity Criteria Database.

USEPA. 1991. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors".* OSWER Directive 9285.6-03.

USEPA. 2011. *National Ambient Air Quality Standards.* http://www.epa.gov/air/criteria.html (Accessed February 2013)

USEPA. 2012. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*. November.

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Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R. Peterson. 2006. *The World Health Organization Re-Evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds*. Toxicological Sciences. ToxSci Advance. Access published on-line on July 7, 2006.

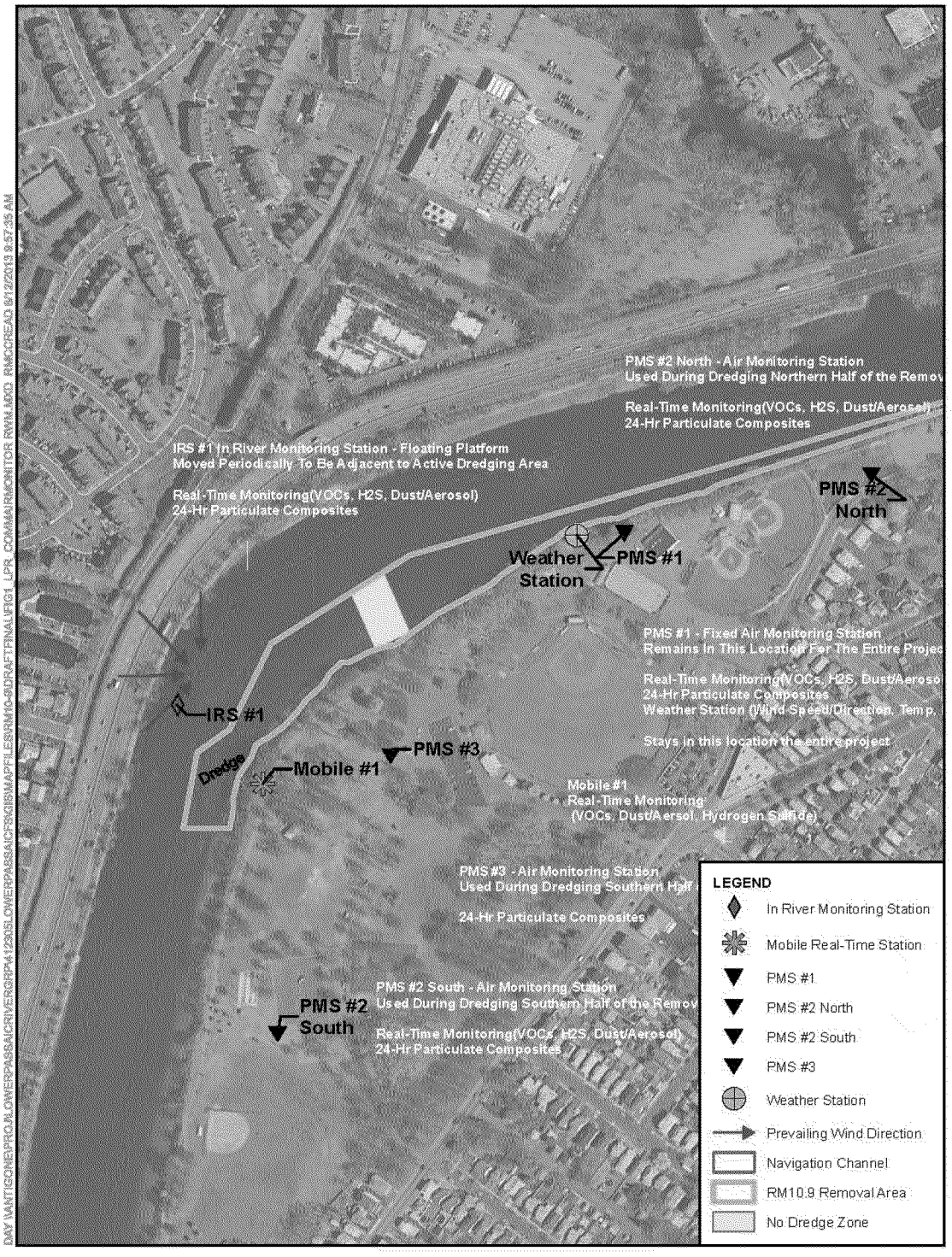

Figure 1 Perimeter Air Monitoring Stations
RM 10.9 Removal Action Air Monitoring Plan
Lower Passaic River Study Area, New Jersey

CH2MHILL

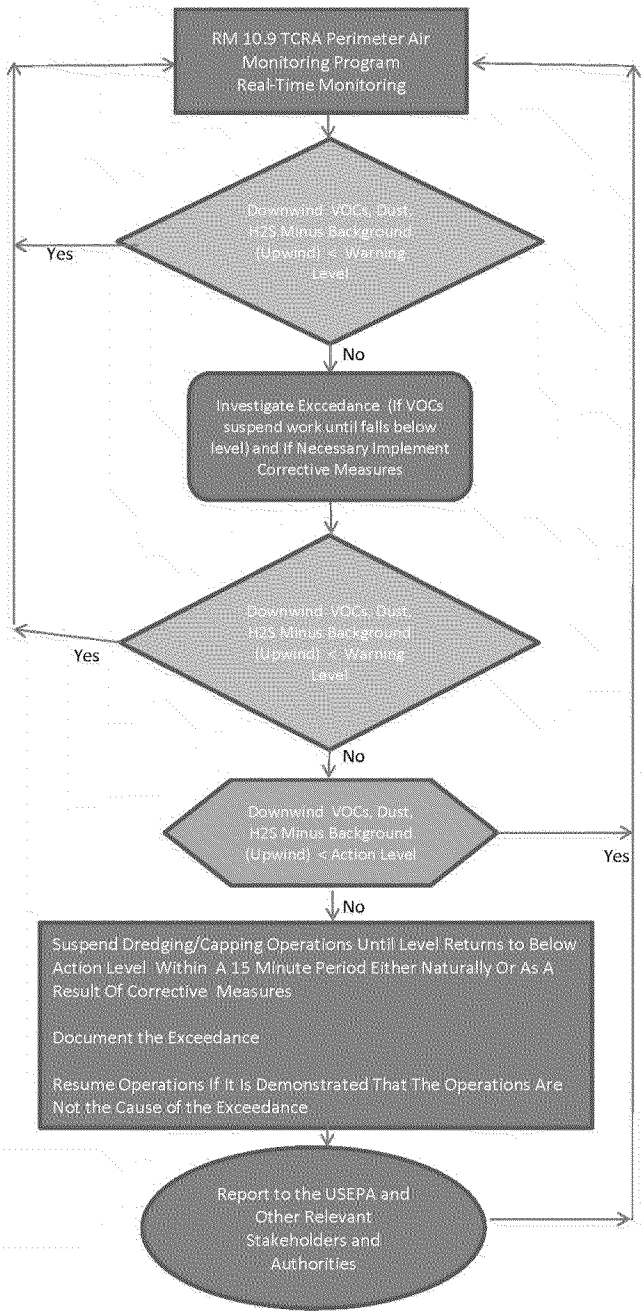

Figure 2. Real-Time Air Monitoring Decision Tree

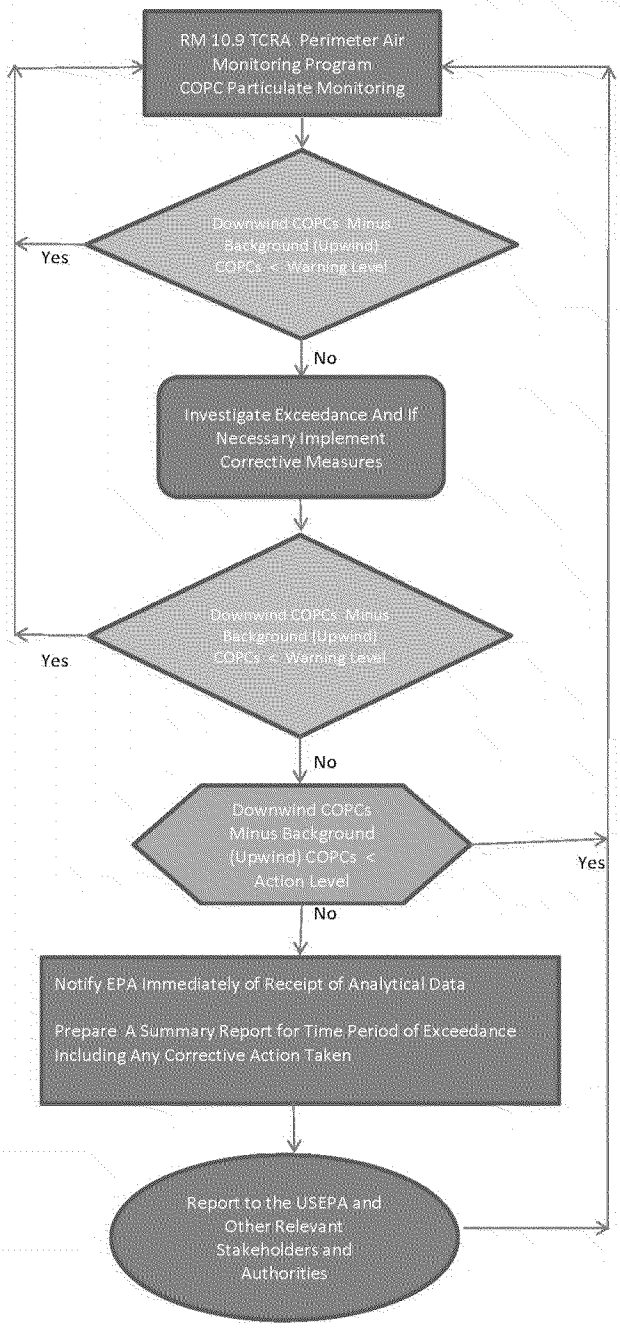

Figure 3 COPCs Particulate Air Monitoring Decision Tree

Attachment 1

Table A-1
Risk-Based Action Levels for Chemicals of Potential Concern: Recreation User (Adult/Child)

Table A-2
Risk-Based Action Levels for Chemicals of Potential Concern: Park Worker (Adult)

Table A-3
Risk-Based Action Levels for Chemicals of Potential Concern: Resident (Adult/Child)

Table A-4
Summary of Calculated Risk-Based Action Levels for Chemicals of Potential Concern

Table A-1

Risk-Based Action Levels for Chemicals of Potential Concern: Recreational User (Adult/Child)

RM 10.9 Removal Action

Lower Passaic River Study Area, New Jersey

Chemical	Inhalation Reference Concentration (mg/m^3)	Source	Basis	Target Organ	Inhalation Unit Risk ($\mu g/m^3)^{-1}$	Source	Noncarcinogenic Risk-Based Action Level THQ = 1 ($\mu g/m^3$)	Carcinogenic Risk-Based Action Level TCR = 1E-06 ($\mu g/m^3$)	Minimum Risk-Based Action Levels for Recreational User ($\mu g/m^3$)
Mercury	3.0E-04	IRIS, HEAST	Chronic, Subchronic	Nervous system, Autoimmune	NA	NA	9.7E+00	--	9.7E+00
PCBs	3.0E-05	IRIS	Chronic	Immune System, Ocular, Toe and Finger Nail	5.7E-04	IRIS	9.7E-01	4.0E+00	9.7E-01
2,3,7,8-TCDD	4.0E-08	Cal EPA	Chronic	Reproductivity	3.8E+01	Cal EPA	1.3E-03	6.0E-05	6.0E-05

Noncarcinogenic calculations:

$$\textbf{Noncarcinogenic Risk-Based Action Level } (\mu g/m^3) = \frac{THQ \times ATnc \times 1000\ \mu g/mg}{EF \times ED \times ET \times (1/RfC)}$$

$$\textbf{Noncarcinogenic Risk-Based Action Level } (\mu g/m^3) = \frac{THQ \times RfDi \times BW \times ATnc \times 1000\ \mu g/mg}{EF \times ED \times ET \times InhR}$$

Carcinogenic calculations:

$$\textbf{Carcinogenic Risk-Based Action Level } (\mu g/m^3) = \frac{TCR \times ATc}{EF \times ED \times ET \times IUR}$$

EXPOSURE ASSUMPTIONS	
ATnc - Averaging time for noncarcinogens (days)	365
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	90
ED - Exposure duration (year)	1
ET - Exposure time (3-hr exposure time/24-hr day)	0.125
TCR - Target cancer risk	1.0E-06
THQ - Target hazard quotient	1

Notes:

Cal EPA = California EPA

IRIS = Integrated Risk Information System (accessed February 2013)

IUR = Inhalation unit risk

NA = Not available/not applicable

Noncarcinogenic risk-based level calculated such that total HQ for a target organ does not exceed 1

PCBs = Polychlorinated biphenyls

Aroclor 1254 oral reference dose (2×10^{-5} mg/kg-day) used to account for non-cancer effects for PCBs by using following ing conversion:

$$RfC\ (mg/m^3) = \frac{\text{Oral RfD } (2 \times 10^{-5}\ mg/kg\text{-}day) \times \text{Body Weight } (15\ kg\text{ - child})}{\text{Inhalation Rate } (10\ m^3/day\text{ - child})}$$

RfC = Reference concentration for inhalation

TCDD = Tetrachlorodibenzo-p-dioxin

Table A-2

Risk-Based Action Levels for Chemicals of Potential Concern: Park Worker (Adult)

RM 10.9 Removal Action

Lower Passaic River Study Area, New Jersey

Chemical	Inhalation Reference Concentration (mg/m^3)	Source	Basis	Target Organ	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Source	Noncarcinogenic Risk-Based Action Level THQ = 1 ($\mu g/m^3$)	Carcinogenic Risk-Based Action Level TCR = 1E-06 ($\mu g/m^3$)	Minimum Risk-Based Action Levels for Park Worker ($\mu g/m^3$)
Mercury	3.0E-04	IRIS, HEAST	Chronic, Subchronic	Nervous system, Autoimmune	NA	NA	3.7E+00	--	3.7E+00
PCBs	7.0E-05	IRIS	Chronic	Immune System, Ocular, Toe and Finger Nail	5.7E-04	IRIS	8.5E-01	1.5E+00	8.5E-01
2,3,7,8-TCDD	4.0E-08	Cal EPA	Chronic	Reproductivity	3.8E+01	Cal EPA	4.9E-04	2.2E-05	2.2E-05

Noncarcinogenic calculations:

$$\text{Noncarcinogenic Risk-Based Action Level } (\mu g/m^3) = \frac{THQ \times ATnc \times 1000\ \mu g/mg}{EF \times ED \times ET \times (1/RfC)}$$

Carcinogenic calculations:

$$\text{Carcinogenic Risk-Based Action Level } (\mu g/m^3) = \frac{TCR \times ATc}{EF \times ED \times ET \times IUR}$$

EXPOSURE ASSUMPTIONS	
ATnc - Averaging time for noncarcinogens (days)	365
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	90
ED - Exposure duration (year)	1
ET - Exposure time (8-hr exposure time/24 hr-day)	0.33
TCR - Target cancer risk	1.0E-06
THQ - Target hazard quotient	1

Notes:

Cal EPA = California EPA

IRIS = Integrated Risk Information System (accessed February 2013)

IUR = Inhalation unit risk

NA = Not available/not applicable

Noncarcinogenic risk-based level calculated such that total HQ for a target organ does not exceed 1

PCBs = Polychlorinated biphenyls

Aroclor 1254 oral reference dose (2×10^{-5} mg/kg-day) used to account for non-cancer effects for PCBs by using follow ing conversion:

$$RfC\ (mg/m^3) = \frac{\text{Oral RfD } (2 \times 10^{-5}\ mg/kg\text{-day}) \times \text{Body Weight } (70\ kg\text{ - adult})}{\text{Inhalation Rate } (20\ m^3/day\text{ - adult})}$$

RfC = Reference concentration for inhalation

TCDD = Tetrachlorodibenzo-p-dioxin

Table A-3
Risk-Based Action Levels for Chemicals of Potential Concern: Resident (Adult/Child)
RM 10.9 Removal Action
Lower Passaic River Study Area, New Jersey

Chemical	Inhalation Reference Concentration (mg/m^3)	Source	Basis	Target Organ	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Source	Noncarcinogenic Risk-Based Action Level THQ = 1 ($\mu g/m^3$)	Carcinogenic Risk-Based Action Level TCR = 1E-06 ($\mu g/m^3$)	Minimum Risk-Based Action Levels for Resident ($\mu g/m^3$)
Mercury	3.0E-04	IRIS, HEAST	Chronic, Subchronic	Nervous system, Autoimmune	NA	NA	1.2E+00	--	1.2E+00
PCBs	3.0E-05	IRIS	Chronic	Immune System, Ocular, Toe and Finger Nail	5.7E-04	IRIS	1.2E-01	5.0E-01	1.2E-01
2,3,7,8-TCDD	4.0E-08	Cal EPA	Chronic	Reproductivity	3.8E+01	Cal EPA	1.6E-04	7.5E-06	7.5E-06

Noncarcinogenic calculations:

$$\text{Noncarcinogenic Risk-Based Level } (\mu g/m^3) = \frac{THQ \times ATnc \times 1000\ \mu g/mg}{EF \times ED \times ET \times (1/RfC)}$$

Carcinogenic calculations:

$$\text{Carcinogenic Risk-Based Level } (\mu g/m^3) = \frac{TCR \times ATc}{EF \times ED \times ET \times IUR}$$

EXPOSURE ASSUMPTIONS	
ATnc - Averaging time for noncarcinogens (days)	365
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	90
ED - Exposure duration (year)	1
ET - Exposure time (24-hr exposure time/24-hr day)	1
TCR - Target cancer risk	1.0E-06
THQ - Target hazard quotient	1

Notes:
Cal EPA = California EPA
IRIS = Integrated Risk Information System (accessed February 2013)
IUR = Inhalation unit risk
NA = Not available/not applicable
Noncarcinogenic risk-based level calculated such that total HQ for a target organ does not exceed 1
PCBs = Polychlorinated biphenyls
Aroclor 1254 oral reference dose (2×10^{-5} mg/kg-day) used to account for non-cancer effects for PCBs by using follow ing conversion:

$$RfC\ (mg/m^3) = \frac{\text{Oral RfD } (2 \times 10^{-5}\ mg/kg\text{-day}) \times \text{Body Weight (15 kg - child)}}{\text{Inhalation Rate (10 } m^3\text{/day - child)}}$$

RfC = Reference concentration for inhalation
TCDD = Tetrachlorodibenzo-p-dioxin

Table A-4
Summary of Calculated Risk-Based Action Levels for Chemicals of Potential Concern
RM 10.9 Removal Action
Lower Passaic River Study Area, New Jersey

Analyte	Risk-Based Action Levels ($\mu g/m^3$)	Risk-Based Action Levels (ng/m^3)	Receptor Group	Exposure Setting	Exposure Time (hr/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Basis of Assumed Toxicity
Mercury	3.7E+00	3.7E+03	Adult	Park Worker/ Sub-Chronic	8	90	1	Mercury (elemental)
PCBs	8.5E-01	8.5E+02						Aroclor 1254
2,3,7,8-TCDD	7.1E-05	7.1E-02						2,3,7,8-TCDD
Mercury	9.7E+00	9.7E+03	Child/Adult	Recreational/ Sub-Chronic	3	90	1	Mercury (elemental)
PCBs	9.7E-01	9.7E+02						Aroclor 1254
2,3,7,8-TCDD	1.9E-04	1.9E-01						2,3,7,8-TCDD
Mercury	1.2E+00	1.2E+03	Child/Adult	Residential/ Sub-Chronic	24	90	1	Mercury (elemental)
PCBs	1.2E-01	1.2E+02						Aroclor 1254
2,3,7,8-TCDD	7.5E-06	7.5E-03						2,3,7,8-TCDD

Notes:
Calculated ambient air risk-based levels reflect the lower of the target excess lifetime cancer risk level of 1E-06 for carcinogens or a taget hazard quotient of 1 for noncarcinogens.
NA - not available/not applicable
PCBs = Polychlorinated biphenyls; Aroclor 1254 toxicity values used as surrogate
TCDD = Tetrachlorodibenzo-p-dioxin
Sub-chronic exposure assumed during dredging project that is planned for completion within 90 days.